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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/611,589	06/30/2003	B. Michelle Chen	AMAT/1717.D2/CPES/DT/PJS	5241

7590 09/11/2006

Patent Counsel  
APPLIED MATERIALS, INC.  
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EXAMINER
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WYSZOMIERSKI, GEORGE P

ART UNIT	PAPER NUMBER
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1742

DATE MAILED: 09/11/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

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<b>Office Action Summary</b>	<b>Application No.</b> 10/611,589	<b>Applicant(s)</b> CHEN ET AL.	
	<b>Examiner</b> George P. Wyszomierski	<b>Art Unit</b> 1742	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 07 July 2006.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1,5-9,11-14,20 and 21 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,5-9,11-14 and 21-28 is/are rejected.
- 7) ☒ Claim(s) 29 and 30 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date <u>8/17/06</u> . | 6) <input type="checkbox"/> Other: _____  |

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1. Applicant's response filed July 7, 2006 has been considered. The pending claims are claims 1, 5-9, 11-14, and 21-30. The IDS filed August 17, 2006 has been considered. Reference "C4" on that IDS has been crossed out because substantial portions of that reference as filed are illegible.

2. Claims 1, 5-9, 11-14, and 21-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over the Sandhu et al. Advanced Metallization Conference reference in view of Kitazawa et al. (U.S. patent 6,178,623).

Sandhu discloses electroplating copper on a substrate followed by heat treating for 5 minutes in an atmosphere comprising nitrogen and hydrogen at a temperature of, e.g. 200 or 250 degrees C (see Figures 5 and 6 of Sandhu). With respect to the "first chamber" and "second chamber" limitations, it appears that Sandhu performs the annealing in a "Blue M inert gas oven" (see page 211 of Sandhu), which would be a chamber distinct from that in which the electroplating of Sandhu is performed.

Sandhu does not disclose rinsing prior to heat treating, does not specify bringing the substrate in proximity to a cooling plate to cool the substrate to a certain temperature, does not specify a hydrogen content less than 4% as in instant claim 4, does not specify treating in an environment of less than 100 ppm oxygen as required by instant claims 8 and 13, and does not specify a pressure of 760 torr as required by claims 9 and 14. These differences are not seen as resulting in a patentable distinction between the prior art and the claimed invention because:

a) Kitazawa, particularly column 11, lines 23-26 therein, indicates it was conventional in the art, at the time of the invention, to rinse an electroplated copper layer prior to heat treatment in an inert atmosphere such as a nitrogen atmosphere.

b) The temperatures to which the substrate is cooled in the instant claims, and at which the cooling plate is maintained in claims 23 and 26, include room temperature. The examiner's position is that any industrial process that involves heated material, such as those described by Sandhu, would include a final step of cooling the heated material to room temperature. Any apparatus involved in this step would be "maintained" at this temperature by virtue of its being exposed to ambient air. New claim 27 states that bringing the substrate in proximity to a cooling plate occurs within the same chamber as the heat treatment, and one of skill in the art would want to utilize an arrangement as compact as practical in the prior art in order to minimize the space required for the prior art process.

c) Sandhu performs annealing both in a substantially nitrogen atmosphere and in a 95% nitrogen-5% hydrogen atmosphere; see Figure 5 of Sandhu and its accompanying text. Thus, the use of an atmosphere between these two particular embodiments, e.g. one with less than 4% hydrogen, would fall within the purview of Sandhu.

d) With respect to oxygen, page 211 of Sandhu emphasizes that the copper in the prior art readily reacts with oxygen and therefore it is important to anneal in a controlled, inert environment. Thus, use of a severely limited amount of oxygen as presently claimed would have been obvious from the Sandhu disclosure.

e) Sandhu page 213 indicates that the oven used for heat treating in the prior art was not leak tight and operates only at 0.5 psi (26 torr) higher than atmospheric pressure (760 torr). This difference of approximately 3.4% in the pressure between the prior art and the claimed invention is held to be of no patentable moment.

Consequently, the combined disclosure of Sandhu et al. together with that of Kitazawa et al. would have rendered the claimed invention obvious to one of ordinary skill in the art.

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3. In the July 7, 2006 response, Applicant states that allowing a substrate to cool to room temperature is not equivalent to bringing a substrate in proximity to a cooling plate. The examiner respectfully disagrees because the word "proximity" is a relative term, and the substrates of the prior art would thus be in "proximity" to cooler materials which would permit those substrates to cool to room temperature. However, the examiner agrees that the prior art does not disclose or suggest bringing the substrate in proximity to a cooling plate to cool the substrate to below 100.deg.C within the same chamber as the heat treatment. Thus, claims 29 and 30 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

4. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).


A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

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5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to George Wyszomierski whose telephone number is (571) 272-1252. The examiner can normally be reached on Monday thru Friday from 8:00 a.m. to 4:30 p.m. Eastern time.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy King, can be reached on (571) 272-1244. All patent application related correspondence transmitted by facsimile must be directed to the central facsimile number, (571)-273-8300. This Central FAX Number is the result of relocating the Central FAX server to the Office's Alexandria, Virginia campus.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

  
GEORGE WYŻOMIERSKI  
PRIMARY EXAMINER  
GROUP 1700

GPW

September 1, 2006